

INVESTIGATION 7

DNA and Its Structure

OBJECTIVES

- To understand the basic structure of the DNA molecule
- To construct a model of the DNA molecule
- To identify and label the molecular structure of DNA

Problem

What is DNA? What is the structure of DNA?

DNA, the abbreviation for deoxyribonucleic acid, is sometimes called the "blueprint of life." This is because the DNA molecule is responsible for hereditary traits and protein synthesis. It also controls all cell activities in living things. This marvelous chemical is the substance of genes, which are located on chromosomes in cell nuclei.

The basic unit of DNA is called a *nucleotide* and contains a deoxyribose (sugar) molecule, a phosphate, and a base. In the early 1950's, James Watson and Francis Crick proposed a model of the DNA molecule in the shape of a double helix — a twisted, spiral ladder. This tremendous discovery has helped scientists to understand how DNA controls protein synthesis, hereditary traits, and other cell activities.

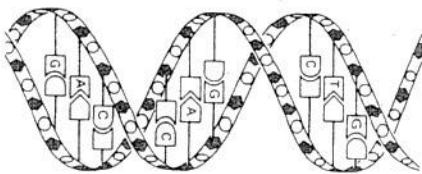
Part II Investigation

(A) On your Data Sheet, look at the structural formulas and models of deoxyribose, phosphate, and the four bases — guanine, thymine, cytosine, and adenine. These are the building blocks of DNA.

The DNA molecule is in the shape of a double helix. A helix is a spiral shape. The double helix forms the sides of the molecule or "twisted ladder" as shown.

The sides are composed of alternating units of deoxyribose sugar and phosphate. The internal building blocks of the molecule, or rungs of the ladder, are composed of nitrogen-containing bases that are joined to the sides. The basic unit of DNA is called a *nucleotide* and consists of a deoxyribose molecule, a phosphate, and one of the bases.

There are four types of bases in DNA. Two of the bases are *purines*. The purines are *adenine* and *guanine*. The other two bases are *pyrimidines*, called *thymine* and *cytosine*. The bases are known by their code letters A, G, T, and C. These bases always bond in a certain way. Adenine bonds only to thymine and guanine bonds only to cytosine. Label the helix diagram on your Data Sheet page, filling in the base code letters and the nucleotide labels. Answer questions 8–14.



(2) Why is it important for scientists to know the structure of DNA? _____

(3) What molecules make up the ladder sides of DNA? _____

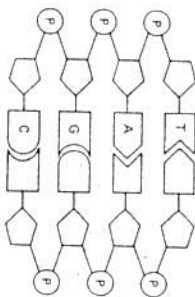
(4) What are the internal blocks or rungs of the DNA ladder? _____

(5) What is the basic unit of DNA? _____

(6) Name the molecules in the basic unit of DNA. _____

Investigation

(A) In the diagram below, label each part of the helix and fill in the base code letters that correspond to the correct nucleotide. Be sure to label: phosphate, deoxyribose, carbon-nitrogen bond, carbon-oxygen bond, guanine, cytosine, thymine, and adenine.



(8) Given the following code letters, predict to which base each would be bonded.

A G T C T T C G A G T A C G G

(9) What is the general **shape** of the DNA molecule? _____

(10) What comprises the backbone or side pieces of the DNA molecule? _____

(11) What are the three basic units or molecules of DNA? _____

(12) What is this three-part unit called? _____

(13) What are the purine bases of DNA? _____

... the pyrimidine bases of DNA? _____

(14) In what combination do these bases bond together? _____

Summary

(1) Why is DNA called the "blueprint of life"? _____
